

Code Analysis

APPLICABLE CODES

Commonwealth of Massachusetts State Building Code 780 CMR, 7TH Edition
Commonwealth of Massachusetts Fuel Gas and Plumbing Code 248 CMR
Commonwealth of Massachusetts Elevator Regulations 524 CMR
Commonwealth of Massachusetts Architectural Access Board Regulations 521 CMR (MAAB)

PROJECT DATA

Areas:	Lower Level	5,890 GSF
	Main Level	6,400 GSF (includes portico areas)
	Upper Level	5,780 GSF
	Attic	4,390 GSF
	Total	22,460 GSF

Occupant Count: Total 560 Occupants

CODE CLASSIFICATIONS

Construction Type: III B (Existing Masonry Bearing Wall Exterior, Wood Frame Interior)
Use Group: A-2 (This assembly use is intended for food and/or drink consumption including banquet hall. The large multi-purpose room will have lunch service and can be used or rented out for banquet type functions.)

	Allowable	Existing/Proposed
Area	9,500 SF	6,400 GSF
Stories	2 + 1 (sprinkler increase)	3
Height	55 FT + 20 FT (sprinkler increase)	+/- 44 FT

Fire Suppression: The existing building does not have a fire suppression system. A new fire suppression system will be installed as a part of this project.

Frontage Increase: The 96.6% of perimeter of the building is accessible (404'-0" of perimeter, 18'-0" without 20'-0" open space).

Required fire resistance ratings of structural elements:

Structural Frame	0 hours
Bearing Walls	20 min
Non Bearing Walls	0 hours
Floors	0 hours
Roofs	0 hours
Exits and stairs	1 hours (1 stair connecting 2 stories may be unenclosed)
Shafts	1 hours
Separations	Not Applicable
Corridors	0 hours

Egress: Minimum Stair Width: .2" x 280 occupants = 56" (4'-8")
Minimum Exit Discharge Width: .15" x 280 occupants = 42"
Allowable length of exit access travel = 250 feet.

Plumbing Fixtures: There are mens and womens toilet rooms on each floor. For "Hall" occupancy with 560 Occupants.

280 women:	1 per 50 = 6 toilet fixtures
	1/200 = 2 Lavatories
280 men:	1 per 100 = 3 toilet fixtures
	1/200 = 2 Lavatories

CHAPTER 34 LATERAL LOAD RESISTING SYSTEMS

Chapter 34 of the state building code deals with evaluation of existing buildings. This chapter has changed frequently in the last few years, and is expected to be completely overhauled in the near future with the 8th Edition of the state building code. The following analysis is based on the International Existing Building Code (IEBC 2009) with Massachusetts amendments and the latest version of the proposed Chapter 34 changes. Generally, the Massachusetts changes are not too significant from the base IEBC.

1. There is a "change of occupancy" as defined in the IEBC (*"A change in the purpose or level of activity within a building that involves a change in application of the requirements of this code."*) This project meets this definition on two counts: 1) the purpose or level of activity is changing and 2) the building needs to be re-evaluated in terms of egress, fire protection systems, etc. Changes of occupancy are addressed in Chapter 9 of the IEBC.
2. Since the work area will exceed 50% of the building area, the project would also be considered a "Level 3" Alteration under the IEBC.
3. Historic buildings are addressed in Chapter 11 of the IEBC. Chapter 11 references Chapter 9 for the change of occupancy; and Chapter 8 for the structural provisions of Level 3 Alteration. Note that the balance of Level 3 alteration requirements need not be met. The structural provisions of both Level 1 and Level 2 alterations would also need to be met.
4. Compliance Alternatives are still an option in Massachusetts (this concept is not in the IEBC).
5. A Chapter 34 report is required.

Following is our interpretation of the structural requirements referenced above. Basically, it looks like the building will need to be laterally load braced to new-construction requirements for wind and seismic loads.

Level 1 Alterations

- Reroofing which increases dead load by 5% or more must be evaluated for gravity loads;
- Reroofing must include installation of wall anchors at the roof line (This would likely be required under Level 3 anyhow).

Level 2 Alterations

- Alterations shall not decrease the capacity of gravity load carrying structural elements unless they comply with the IBC (ie the code for new construction)
- Section 707.5 addresses "demand-capacity ratio" of lateral-load resisting elements which are impacted by the alteration: where alteration results in a "structural irregularity" as defined in ASCE-7, upgrade is required in accordance with Section 807.4 (Level 3).

Level 3 Alterations

- Structural engineering analysis of lateral load resisting elements and upgrades to comply with the IBC for wind and seismic loads. Seismic compliance requirements are outlined in Section 101.5.4.1. State building code also added a section on cumulative effects, but that would not be applicable for this project.

Refer to the following Chapter 34 level of work determination table and excerpt from relevant section of the building code for descriptions of what these levels entail. The table assumes the least anticipated amount of work that may be required. The comments made here about chapter 34 requirements may become obsolete by the time any work on this building actually begins.

Massachusetts 7th edition commercial building code

Chapter 34 level of structural work determination (as of October 9, 2009)
includes emergency amendments up until 10/9/09

Anticipated Chapter 34 Structural Level

Basis for Estimate

issue #	level	issue	instruction	comments	enter the level (yellow cells only) that applies for this issue ("0" indicates "does not apply")
1	1	Level 1 is the default if none of the other levels apply	"1" entered automatically		1
2	1	Removal or repair of ceilings, partitions, or interior facing of exterior walls; new ceilings, partitions, or interior facing of exterior walls; reconstruction or repair of floors; new mechanical or electrical distribution systems within an area; or new elevators, escalators, or stairs within an area or serving an area, when the new openings in any framed floor or roof are 5% or less of the area of the framed floor or roof.	IF YES, ENTER "1"		1
3	-	Increase in total framed floor and roof area due to structurally attached additions	ENTER MAXIMUM OF BELOW	An addition is not being considered for this submission. If an addition is later added to the scope, then a seismically separated addition (has its own wall alongside the existing exterior wall with a gap between the two walls, instead of sharing the wall), then this could still be a zero. If the addition is structurally attached, this is likely a "4".	0
-	2	Increase in total framed floor and roof area due to structurally attached additions up to a lifetime limit of 10% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.	IF YES, ENTER "2"		
-	4	Increase in total framed floor and roof area due to structurally attached additions that is more than 10% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.	IF YES, ENTER "4"		
-	5	Structurally attached additions that have a total framed floor and roof area greater than 100% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.	IF YES, ENTER "5"		
4	-	Increase in effective seismic weight	ENTER MAXIMUM OF BELOW	Not anticipating any increase in building/seismic weight (unless there is a future structurally attached addition).	0
-	2	Increase in effective seismic weight, with or without structurally attached additions, up to a lifetime limit of 10% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.	IF YES, ENTER "2"	Anticipating that this will be a "zero" (unless there is a structurally attached addition, in which case it will likely be a "4").	
-	4	Increase in effective seismic weight, with or without structurally attached additions, that is more than 10% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.	IF YES, ENTER "4"		
-	5	Increase in effective seismic weight, with or without structurally attached additions, that is more than 100% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.	IF YES, ENTER "5"		

5	-	structural work on existing framed floor or roof areas	ENTER MAXIMUM OF BELOW IF YES, ENTER "2"	Anticipate for study that at least 25% of the existing floor framing will need structural reinforcing, but that we will not be "removing or reconstructing" more than 15% of floors. Anticipate level "2" for this study.	2
-	2	Structural work involving: More than 25% of the total existing framed floor and roof area or 20,000 sf of existing framed floor and roof area, whichever is less. Where the work involves existing beams or girders, the tributary area of the beams and girders shall be included in the count for framed floor and roof area.			
-	3	Removal, or removal and reconstruction, of between 15% and 40% of the total tributary area of horizontal framing of existing framed floors and roofs. Exception: Demolition of a previous addition to the building; demolition of an appendage to the building such as a loading dock outside of the exterior wall line; or demolition of a mechanical penthouse, with the condition that the demolition does not reduce the existing lateral load resistance of the remaining portion of the building below that provided before demolition.	IF YES, ENTER "3"		
6	-	structural work on lateral load resisting elements (existing shear walls, lateral load frames, or diaphragms, or new shear walls)	ENTER MAXIMUM OF BELOW	Anticipate that shear walls consist of exterior walls and possibly the pairs of interior shaft/chimney walls on each side of the building. We would expect these walls to be left intact for all options. We would anticipate that additional or new lateral load resisting elements are not likely to be needed, but this will depend on what chapter 34 structural level is required, as the higher the level, the higher the lateral loads that have to be designed for. Anticipate less than 90% of lateral loads would be taken by new framing.	0
	2	Structural work involving: More than 25% of the total area of shear walls above the foundation	IF YES, ENTER "2"		
	2	Structural work involving: Changes to any structural wall that reduce its in-plane shear resistance (ability to act as shear wall) by more than 15%	IF YES, ENTER "2"		
	2	Structural work involving: Changes to any floor or roof diaphragm that reduce its in-plane shear resistance by more than 15%	IF YES, ENTER "2"		
	2	Structural work involving: Removal or reconfiguration of lateral load resisting frames, or foundations supporting them	IF YES, ENTER "2"		
	3	New shear walls and vertical frames which provide more than 35 % of the lateral force resistance required for Level 2 Work, in either of two orthogonal directions.	IF YES, ENTER "3"		
	5	New shear walls and vertical frames which provide more than 90% of the lateral force resistance required for Level 3 Work, in either of two orthogonal directions.	IF YES, ENTER "5"		
7	-	structural work on openings and removal/reconstruction of floors/roofs	ENTER MAXIMUM OF BELOW	We would not anticipate that either of these to apply to this project	0
	2	Structural work involving: Openings in any framed floor or roof that have an area more than 5% of the area of the framed floor or roof	IF YES, ENTER "2"		
	5	The removal, or the removal and reconstruction, of more than 40% of the total tributary area of horizontal framing of existing framed floors and roof. Exception: Demolition of a previous addition to the building; demolition of an appendage to the building such as a loading dock outside of the exterior wall line; or demolition of a mechanical penthouse, with the condition that the demolition does not reduce the existing lateral load resistance of the remaining portion of the building below that provided before demolition.	IF YES, ENTER "5"		
8	-	structural work on columns or diagonal braces		Even if this clause were tripped, we would not expect it to control the chapter 34 structural level	
	2	Structural work involving: More than 25% of the total length of columns and diagonal braces	IF YES, ENTER "2"		2

9	-	change of use			We suspect that the proposed use as a Senior Center would make this an A-3 use group. This clause would only be tripped if there were a 1200 person or more occupancy load, which we are not anticipating.	0
	5	Change of Use and Work for Restricted Uses. Change of use of an existing building to a restricted use, or work above Level 2 for existing buildings with restricted uses, shall comply with the requirements for Level 5 Work. (See 3408.5.1 for Restricted Uses defined)		IF YES, ENTER "5"		
10	-	exemptions			We are not expecting this to be applicable	0
	2	Exemption for Pile Foundations. Structural repairs of pile foundations are exempt from Level 2 Work		special condition		
<u>MINIMUM anticipated level:</u>						2

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or without structurally attached additions, that is more than 100% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

4. New shear walls and vertical frames which provide more than 90% of the lateral force resistance required for Level 3 Work, in either of two orthogonal directions.

3408.5 Restricted Uses.

3408.5.1 Restricted Uses Defined. For the purposes of 780 CMR 3408.0, restricted uses shall be as follows:

1. Assembly Groups A-1 and A-2 for an occupant load of 600 or more.
2. Assembly Group A-3 for an occupant load of 1200 or more.
3. Assembly Groups A-4 and A-5 for an occupant load of 600 or more.
4. Hazardous Group H.
5. Institutional Group I-2 for an occupant load of 400 or more.
6. Institutional Group I-3.
7. Buildings in Seismic Use Group III, as defined in ASCE, Table 9.1.3.

3408.5.2 Change of Use and Work for Restricted Uses. Change of use of an existing building to a restricted use, or work above Level 2 for existing buildings with restricted uses, shall comply with the requirements for Level 5 Work.

3408.6 Structural Investigation of Existing Buildings.**3408.6.1 Level 1 Work.**

3408.6.1.1 Responsibility of the SER. Whenever there is any structural work for Level 1 Work, the SER shall perform the following tasks.

1. Verify that the work to be performed is in fact Level 1 Work.
2. Make a field investigation of the areas and structural members affected by the proposed structural work.
3. Evaluate the capacity of existing structural elements affected by the proposed structural work.

3408.6.1.2 Responsibility of the Architect. The architect of record shall verify that the changes to the existing building are in fact Level 1 Work, and so certify on the construction drawings.

3408.6.2 Levels 2, 3, 4, and 5 Work.

3408.6.2.1 Initial Survey of Existing Building. The SER shall make an initial survey of the existing building consisting of the following tasks. Alternatively, a registered architect, who will be the architect of record for the project, may substitute for the SER for the

parts of the investigative work that do not require a structural evaluation.

1. Gather and catalog relevant available information on the existing building, such as drawings, specifications, shop drawings, geotechnical engineering reports, previous condition appraisal reports, and building department records.
2. Perform a field survey to either verify the available drawings or to establish dimensions of the existing building, including layout and sizes, of relevant structural components.
3. Perform a field survey to visually assess the condition of the structural components of the existing building.
4. Identify load paths (or lack thereof) to the foundation for gravity load and lateral load, based on information gathered in the above tasks.

3408.6.2.2 Foundation and Geotechnical Explorations.

3408.6.2.2.1 Level 2 Work. If the work does not involve an addition or does not include an increase in gravity loads, and does not involve new shear walls or vertical frames or reinforcement of existing shear walls or vertical frames to resist the lateral loads required in 780 CMR 3408.7.3, and if there is no indication of settlement or lateral movement of basement walls or foundations, no foundation or geotechnical exploration is required. Otherwise, explorations shall be performed as necessary to determine the foundation design parameters of the subsoils and the type and condition of existing foundations.

3408.6.2.2.2 Levels 3, 4, and 5 Work. Explorations shall be performed as necessary to determine the foundation design parameters of the subsoils, the type and condition of existing foundations, and the potential for liquefaction of soils during an earthquake where required in 780 CMR 3408.9.11.

3408.6.2.3 Structural Evaluation of the Existing Building.

3408.6.2.3.1 Existing Structural Materials. The SER shall determine the strengths of existing structural materials in accordance with 780 CMR 3408.9.2.3 and 3408.9.2.4.

3408.6.2.3.2 Repairs. The SER shall evaluate structurally hazardous conditions and determine which existing structural elements or systems are in need of repair or other remedial action, and determine the character and extent of the repairs or remedial action.

3408.6.2.3.3 Gravity Load Capacity -

Level 2 Work. Where there are structural changes to floors or roofs, the SER shall determine the total service load capacity, and the net unreduced service live load capacity or the net service snow load capacity, as applicable, in the affected areas.

3408.6.2.3.4 Gravity Load capacity - Levels 3, 4, and 5 Work. The SER shall determine the total service load capacity of the floors and roofs, the net unreduced service live load capacity of the floors, and the net service snow load capacity of the roofs.

3408.6.2.3.5 Lateral Load Capacity - Levels 2, 3, 4, and 5 Work. The SER shall determine the lateral load capacity of the existing building and its lateral load components relative to the lateral load resistance required for the level of work to be performed, and determine what is needed to provide the required lateral load resistance.

3408.6.2.4 Structural Details. The SER shall evaluate the following details.

1. Connectivity of the structural elements.
2. Existence of anchors connecting floor and roof decks to concrete or masonry walls, and if they exist, their ability to provide lateral support to the walls and transfer in-plane shear from the decks to the plane of the walls.
3. Existence of unreinforced masonry parapets, how they are supported at the roof diaphragm, their height measured from the roof diaphragm, and their thickness.
4. For masonry walls, the ratio of the distance between lateral supports to the thickness of wall.
5. Existence of brittle connections of precast concrete cladding components.

3408.6.3 Report on Structural Investigation. The SER shall submit a report on his structural investigation to the building official with the application for the building permit.

3408.6.4 Condition of Permit. The submission of the SER's report on his structural investigation and review thereof by the building official shall be a condition for the issuance of the building permit. The building official shall maintain this report for future renovations of the building.

3408.6.5 Field Observations During Construction. The SER shall make periodic field visits during the progress of the construction work on the existing building in order to observe and verify the assumed conditions on which the structural design was based, and shall modify the design, as necessary, should the observed conditions differ in any significant manner from those on which the structural design was based. The SER shall provide a written notification to the

building official of changes to the contract documents submitted with the application for building permit.

3408.7 Lateral Load for Existing Buildings and Structurally Attached Additions.

3408.7.1 Application of Lateral Load. Where the work includes structurally attached additions to an existing building, the specified lateral loads in 780 CMR 3408.7 shall be applied to the existing building and additions acting together as a single structure.

3408.7.2 Level 1 Work. There are no requirements for lateral load for Level 1 Work.

3408.7.3 Level 2 Work. For Level 2 Work, each of the following lateral loads shall be applied to the building separately:

1. $\frac{2}{3}$ of the wind load specified in 780 CMR 1609.0.
2. A lateral load in any direction which is 1% of the unfactored gravity load for Allowable Stress Design or 1.5% of the unfactored gravity load for Strength Design, distributed the same as the gravity load. For the purposes of this clause only, the gravity load shall be defined as $D + 0.5S$, where the notation is as defined in 780 CMR 16.00.
3. The wind load specified in the basic code, if any.
4. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

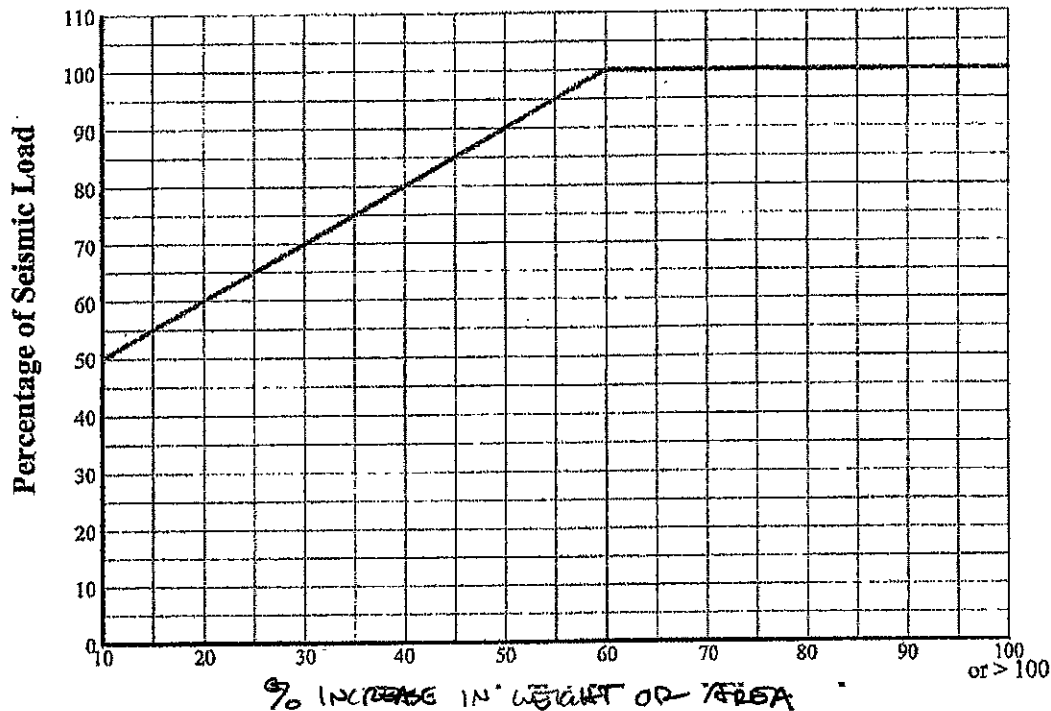
3408.7.4 Level 3 Work. For Level 3 Work, each of the following lateral loads shall be applied to the building separately:

1. The wind load specified in Section 1609.
2. 35% of the seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0, 1615.0, and 3408.10, with a minimum seismic base shear of 0.01W.
3. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

3408.7.5 Level 4 Work. For Level 4 Work, each of the following lateral loads shall be applied to the building separately:

1. The wind load specified in 780 CMR 1609.0.
2. A percentage, given in Figure 3408-1, of the seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0, 1615.0, and 3408.10. In Figure 3408-1, the meaning of the term *effective seismic weight* in the title of the abscissa shall be in accordance with Clauses 3408.4.1, Items 2. and 3.
3. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

**FIGURE 3408.1 PERCENTAGE OF THE SEISMIC LOAD SPECIFIED
IN 780 CMR 1614.0 AND 1615.0**



3408.7.5.1 Buildings Designed for Additional Stories. For Post-1975 buildings which have been designed for additional stories, the seismic load and seismic criteria for new buildings of the basic code may be used in lieu of the criteria in 780 CMR 3408.7.5, Items 2. and 3., with the following conditions:

1. The building (or an addition for which provision was made for the additional stories) was constructed under a building permit whose date is not more than 15 years prior to the date of the application for a building permit for the additional stories.
2. The number of additional stories shall not be more than the number of additional stories provided for in the original design.
3. The size of any story shall not be larger than the footprint of the story immediately below. For partial stories, account shall be taken of torsion induced by the eccentricity.
4. For buildings whose basic code was prior to the 6th Edition of the State Building Code and have rigid or semi-rigid diaphragms, new shear walls or frames shall be located as necessary such that the eccentricity of the shear center at each level from the center of mass at that level is not more than 20% of the building width in each of two orthogonal directions. Alternatively, new shear walls or frames shall be located as necessary so that the building complies with ASCE 7, Section 9.5.5.5.2, as modified by 780 CMR 1615.0. The mass at any level

shall be all of the mass of the building at and above that level.

5. Buildings whose basic code was prior to the 6th Edition of the State Building Code and which have weak stories, as defined in ASCE 7, Table 9.5.2.3.3, shall be reinforced as necessary so that the building meets the criteria of ASCE 7, Section 9.5.2.6.2.4.

3408.7.6 Level 5 Work. For Level 5 work, each of the following lateral loads shall be applied to the building separately.

- 1 The wind load specified in 780 CMR 1609.0.
- 2 The seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0 and 1615.0.

3408.7.7 Historic Buildings. House museums are exempt from the lateral load requirements of 780 CMR 3408.7. Preserved historic buildings shall meet all of the lateral load requirements of 780 CMR 3408.7.

3408.8 Gravity and Other Loads for Existing Buildings and Structurally Attached Additions.

3408.8.1 Live Load. Live load shall be in accordance with 780 CMR 1607.0, with the following exceptions:

3408.8.1.1 Reduced Live Load. Except for Use Groups, F, I, and S, wherever there is a new use in an existing building, and the new use requires a live load in accordance with

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780 CMR 1607.0 that is greater than the original live load capacity, the floors may be posted for the original live load capacity, provided that the use is controlled in a way acceptable to the building official, and so that the public safety is not endangered thereby.

3408.8.1.2 Level 1 Work. Level 1 Work is exempt from the live load requirements of 780 CMR 1607.0 except in areas being altered or repaired.

3408.8.2 Snow Load. Snow load shall be in accordance with 780 CMR 1608.0, with the following exceptions.

3408.8.2.1 Ground Snow Load. For determining snow loads on existing buildings, ground snow load may be reduced to 85% of that required by 780 CMR 1608.0. There shall be no reduction of ground snow load for additions, or for drift loads on existing buildings created by higher additions.

3408.8.2.2 Level 1 Work. Level 1 Work is exempt from the snow load requirements of 780 CMR 1608.0, except for snow drift loads due to new roof top equipment or structures.

3408.8.2.3 Historic Buildings. House museums are exempt from the snow load requirements of 780 CMR 3408.8.2.

3408.8.3 Lateral Soil and Hydrostatic Loads. For additions, lateral soil and hydrostatic loads shall be in accordance with 780 CMR 18.00. There are no requirements for lateral soil and hydrostatic loads for existing basement or foundation walls provided said walls and the structure supporting them laterally do not exhibit structural distress due to lateral soil or hydrostatic load; otherwise, lateral soil and hydrostatic loads shall be in accordance with 780 CMR 18.00.

3408.8.4 Flood Loads. Flood load shall be in accordance with 780 CMR 1612.0 for Level 4 and Level 5 Work. There are no flood load requirements for Levels 1, 2, and 3 Work.

3408.8.5 Dead Loads. Dead loads shall be in accordance with 780 CMR 1606.0.

3408.9 Structural Design and Construction.

3408.9.1. Stiffness and Deflection Control. For Levels 2, 3, 4, and 5 Work, except for Level 2 Work where there are no changes to the existing lateral load resisting system, the building design shall comply with the following deflection criteria.

1. For seismic load on buildings with URM bearing or enclosure walls, the maximum inelastic story drift in the direction of the seismic load shall not exceed $0.007h$, where h is the story height. Inelastic story drift shall be calculated in accordance with ASCE 7, Section 9.5.5.7 or 9.5.6.6, except that the drift deter-

mination shall be made for each shear wall and vertical frame. The drift of URM bearing or enclosure walls perpendicular to the direction of the seismic load shall not exceed $0.010h$.

2. For wind load, or the lateral load defined in 780 CMR 3407.7.3, Item 2., on buildings with URM bearing or enclosure walls, the maximum story drift at each shear wall and vertical frame shall not exceed $0.002h$. The drift of URM bearing or enclosure walls perpendicular to the direction of the lateral load shall not exceed $0.0025h$. These values apply to unfactored load levels.

3. For seismic loads on buildings without URM bearing or enclosure walls, the maximum inelastic story drift shall be calculated in accordance with ASCE 7, Section 9.5.5.7 or 9.5.6.6.

3408.9.1.1 Reinforced Concrete Moment Frames. For seismic load on existing reinforced concrete moment frames of Pre-1975 buildings, including flat slab or flat plate buildings, whether supplemented with new lateral load resisting elements or not, the inelastic story drift shall not exceed 0.01 times the story height.

3408.9.2 Existing Structural Members and Systems.

3408.9.2.1 Strength of Existing Structural Members and Systems. Strength of existing systems, members, and connections shall be determined in accordance with the Code requirements for new construction and currently accepted engineering practice, using the actual strength and other physical properties of the existing materials, except as provided in 780 CMR 3408.9.2.2. and 3408.9.2.4.

3408.9.2.2 Compliance with Previous Codes. For evaluating capacity of existing structural systems, members, or connections for compliance with the basic code, structural design codes and standards in effect at the time of the basic code may be used.

3408.9.2.3 Strength of Materials. The strength of existing materials shall be determined by tests or from generally accepted historical records.

3408.9.2.4 Archaic Materials. Strength of existing systems, members, and connections made from materials no longer produced (archaic materials) may be evaluated from the archaic material codes and engineering practices at, or later than, the time said existing systems and elements were constructed. Existing systems and elements made from archaic materials shall not be used to resist seismic load.

3408.9.2.5 Deficient or damaged structural members. Existing structural members or their connections that are found to be deteriorated or damaged, either prior to or during an alteration or addition, shall be repaired, replaced, or reinforced. Existing structural members shall be considered deteriorated or damaged if their capacity is less than 85% of their original strength. Repairs, replacement, or reinforcement shall be in accordance with currently accepted engineering practice.

3408.9.2.6 Reuse of Existing Structural Members. Existing structural members in sound structural condition may be reused.

3408.9.3 Sheathing for Light-framed Shear Walls. The following types of existing sheathing over light-framed wood walls may be used to resist in-plane shear, where the walls are anchored to floors and to the floor or roof construction above such that they can transfer the shear between stories and to the foundation. wood structural panels, diagonal boards, wood siding over horizontal or diagonal boards, plaster on wood or metal lath, and stucco on metal lath. Gypsum sheathing, lath, wall board, and drywall; fiberboard; and particle board are not permitted for resisting in-plane shear.

Exception. Existing gypsum sheathing, lath, wall board, and drywall; fiberboard; and particle board may be used to resist in-plane shear if originally designed in accordance with 780 CMR for that purpose.

3408.9.4 Connections of Lateral Load Resisting Frames and Walls to Diaphragms. For Levels 2, 3, 4, and 5 Work, all vertical lateral load resisting frames and shear walls (including all masonry and concrete enclosure, bearing, and fire walls) shall be connected to floor and roof diaphragms. The connections shall resist the in-plane forces between diaphragms and vertical frames, and between diaphragms and shear walls. The connections shall also resist imposed forces that are transverse to the vertical frames and shear walls. The in-plane and transverse design forces for these connections shall not be less than 190 lbs per foot for Allowable Stress Design or 280 lbs/foot for Strength Design.

3408.9.5 Shear Walls and Frames for Levels 2, 3, 4, and 5 Work.

3408.9.5.1 Distribution of Lateral Load with Flexible Diaphragms. For buildings with flexible diaphragms, such as wood floor and roof decks or unfilled metal roof decks, and with masonry or concrete shear walls or steel braced frames, the lateral load from each level shall be proportioned to shear walls and braced frames in accordance with their tributary width perpendicular to the load, unless a different distribution is justified by a lateral load

analysis which accounts for the flexibility of the diaphragms and the stiffnesses of the shear walls and frames.

3408.9.5.2. Lines of Shear Walls or Frames with Flexible Diaphragms. For buildings or portions of buildings with flexible diaphragms, such as wood floor and roof decks or unfilled metal roof decks, there shall be a minimum of two lines of shear walls or frames to resist lateral load in each orthogonal direction (or the equivalent), located at or as close as practicable to the opposite sides of the building or portion of the building.

3408.9.5.3 Ductility Requirements for New Shear Walls and Frames. For Level 2 Work, where new shear walls or frames are required, said frames and shear walls shall be detailed in accordance with the seismic requirements of 780 CMR 19.00, 21.00., 22.00, or 23.00, as applicable. The new frames and shear walls shall be one of the types permitted in ASCE 7, Table 9.5.2.2, as revised by 780 CMR 1615.0.

3408.9.6 Row Buildings.

3408.9.6.1 Party Walls. A party wall is defined as a wall on a lot line owned in common by the two abutters. For the purposes of 780 CMR 3408.9.6, where a wall is on one side of a lot line and owned by one of the abutters, and the face of that wall nearest the lot line is within two inches of the lot line, the wall shall be considered to be a party wall.

3408.9.6.2 Lateral Resistance Parallel to Front and Rear Walls. When lateral load resistance of an existing building within a row of buildings with party walls is to be determined, said resistance parallel to the front and rear walls shall be the resistance of the entire row of buildings.

3408.9.6.3 Maintaining lateral load resistance. When an existing building within a row of buildings with party walls is altered, demolished, or replaced, the lateral load resistance and stiffness parallel to the front and rear walls contributed by the existing building to the row of buildings shall be maintained or replaced.

3408.9.6.4 Lateral Support of Party Walls. Where a building within a row of buildings is removed or partially removed, the party walls on each side of the removed structure shall be laterally supported by means other than friction.

3408.9.6.5 New buildings. New structures that replace an existing building in a row of buildings shall not impose lateral forces on the other buildings in the row in excess of what the existing building could have imposed.

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3408.9.7 Precast Concrete Cladding Connections B Levels 4 and 5 Work. Connections of existing precast concrete cladding elements for Levels 4 and 5 Work shall be made to conform to the requirements of 780 CMR 1615.0.

3408.9.8 Special Requirements for URM Walls.

3408.9.8.1 Lateral Support. For Levels 2, 3, 4, and 5 work, the ratio of distance between lateral supports to the nominal thickness of wall shall be 18 or less; otherwise the walls shall be strongbacked. Strongbacks shall be designed to resist the full transverse (out of plane) design load on the URM walls, with a maximum transverse displacement of 1/600 of the distance between lateral supports. In ASCE 7, Equation 9.6.1.3-1, a_p shall be taken as 1.0 and R_p shall be taken as 1.5 for URM walls.

3408.9.8.2 Tying Back Parapets. For Levels 2, 3, 4, and 5 Work, the top of masonry parapets extending from URM walls with a height to thickness ratio of more than three shall be tied back to the roof. The height of parapet shall be measured from the level of where the URM walls are connected to the roof diaphragm.

3408.9.8.3 New Buildings Using Existing Masonry Facades. Existing URM facades may be used to enclose new buildings provided:

1. that the walls are laterally supported by the new building in such a way that there is no imposed in-plane shear transferred to the facade from the building;
2. that seismic load induced into the plane of the walls due to their own mass can be resisted by the respective walls; and
3. that the walls conform to the criteria of 780 CMR 3408.9.8.1 and 3408.9.8.2.

3408.9.9 Limits to Vertical Additions Having URM or Unreinforced Concrete Bearing Walls. For Level 4 Work, structurally attached vertical additions to existing buildings having URM or unreinforced concrete bearing or enclosure walls shall be limited as follows:

1. Only a lifetime one story is permitted to be added to one and two story buildings, and no vertical addition is permitted for buildings with more than two stories.
2. The area of the permitted vertical addition shall not exceed the footprint of the uppermost existing floor.

Exception. There is no limit to the number of stories of a vertical addition if the addition has a new lateral load resisting system such that lateral loads on the addition are not imposed on the existing URM walls, and if no additional gravity load is imposed on the existing URM walls.

3408.9.10 Seismic design with URM and unreinforced concrete shear walls.

3408.9.10.1 Uncracked Shear Walls.

Existing URM and unreinforced concrete shear wall elements acting with a new lateral load resisting system shall be considered to remain uncracked during the design earthquake when the calculated in-plane seismic shear force on the elements multiplied by the system overstrength factor (Ω_o) of the new lateral load resisting system is less than or equal to the shear capacity of the elements.

3408.9.10.2 Levels 3 and 4 Work. When the in-plane seismic shear force in a URM or unreinforced concrete shear wall, calculated in accordance with the design coefficients in Table 3408-1, exceeds the in-plane shear capacity, a new lateral load resisting system of a type permitted in ASCE 7, Table 9.5.2.2, as revised by 780 CMR 1615.0, shall be added to the building to resist the seismic load. The new lateral load resisting system shall be designed to act with existing shear wall elements that remain uncracked in accordance with 780 CMR 3408.9.10.1, accounting for the relative stiffness of the new elements and the uncracked existing shear wall elements, using as an R factor the R factor for the new lateral load resisting system.

3408.9.10.3 Level 5 Work. The primary lateral load resisting system, in accordance with 780 CMR 3408.7.6, Item 2., shall be designed to resist seismic load independent of the URM or unreinforced concrete shear walls. The primary lateral load resisting system shall also be designed to interact with existing shear wall elements that remain uncracked in accordance with 780 CMR 3408.9.10.1, accounting for the relative stiffness of the elements of the primary system and the uncracked existing shear wall elements, using as an R factor the R factor for the primary lateral load resisting system.

3408.9.11 Liquefaction of Underlying Soils. For additions in Level 4 or Level 5 Work, the potential for liquefaction shall be considered in accordance with 780 CMR 1804.6.

3408.10 Supplementary Seismic Provisions for Existing Construction. Where seismic resistance is required in 780 CMR 3408.0, existing lateral force resisting systems that are not permitted in 780 CMR 1615.0 may be used for seismic resistance in accordance with the following requirements.

3408.10.1 Limitation. 780 CMR 3408.10 does not apply to Level 5 Work.

3408.10.2 Design Coefficients and Factors. Values of the Response Modification Coefficient, R, System Over-strength Factor, Ω_o , and the

Deflection Amplification Factor, C_d , for systems not permitted in 780 CMR 1615.0 shall be in accordance with Table 3408-1. Except as provided

in Table 3408-1, there are no seismic design or detailing rules for the systems listed in the table.

TABLE 3408-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE RESISTING SYSTEMS NOT PERMITTED IN 780 CMR 1615.0

Basic Seismic Force Resisting System ¹	Response Modification Coefficient, R	System Overstrength Factor, Ω_o	Deflection Amplification Factor, C_d
Bearing Wall Systems			
Steel concentrically braced frame (CBF) with diagonal ³ or X-bracing			
CBF per 6th Ed SBC ² except AISC 1992 Seismic Provisions, Sect 9.5	3.5	2	3.5
Otherwise ⁴	3	3	3
Steel CBF with V, inverted V, or K bracing			
V or Inverted V bracing per 6th Ed. SBC ²	3	3	3
V or Inverted V bracing, otherwise ⁴	3	3	3
K bracing	1.25	1.25	1.25
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordance with 780 CMR 1113.5.1.4a, 5th Ed.	5	2.5	5
Reinforced concrete shear walls with reinforcing steel less than required by, or spaced further apart than, that required in ACI 318, Sec. 11.10.9	1.5	1.5	1.5
Unreinforced concrete shear walls	1.25	1.25	1.25
Reinforced masonry shear walls classified in accordance with 780 CMR 3408.10.2.1			
Class A	4.5	2.5	3.5
Class B	2.25	2.25	2.25
Class C	1.25	1.25	1.25
Unreinforced masonry shear walls	1.25	1.25	1.25
Light-framed walls sheathed with wood structural panels or diagonal sheathing	4	2.5	3
Other light-framed walls sheathed with materials permitted in 780 CMR 3408.10.6	2	2	2
Building Frame Systems			
Steel concentrically braced frame (CBF) with diagonal ³ or X-bracing			
CBF per 6th Ed SBC ² except AISC, 1992 Seismic Provisions, Sect 9.5	4	2	3.5
Otherwise ⁴	3	3	3
Steel CBF with V, inverted V, or K bracing			
V or Inverted V bracing per 6th Ed. SBC ²	3	3	3
V or Inverted V bracing, otherwise ⁴	3	3	3
K bracing	1.5	1.5	1.5
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordance with 780 CMR 1113.5.1.4a, 5th Ed.	6	2.5	5
Reinforced concrete shear walls with reinforcing steel less than required by, or spaced further apart than, that required in ACI 318-02, Sec. 11.10.9	1.5	1.5	1.5
Unreinforced concrete shear walls	1.5	1.5	1.5
Reinforced masonry shear walls classified in accordance with 780 CMR 3408.10.2.1			
Class A	5	2.5	4
Class B	2.25	2.25	2.25
Class C	1.5	1.5	1.5
Unreinforced masonry shear walls	1.5	1.5	1.5
Light-framed walls sheathed with wood structural panels or diagonal sheathing	4	2.5	3
Other light-framed walls sheathed with materials permitted in 780 CMR 3408.10.6	2.5	2.5	2.5

**TABLE 3408-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE
RESISTING SYSTEMS NOT PERMITTED IN 780 CMR 1615.0 - continued**

Basic Seismic Force Resisting System ¹	Response Modification Coefficient, R	System Overstrength Factor, Ω_o	Deflection Amplification Factor, Cd
Moment Resisting Frame Systems			
Steel moment frames			
Special Moment Frame per 6th Ed. SBC ²	8	3	5.5
Ordinary Moment Frame per 6th Ed. SBC ²	3.5	3.5	3.5
Moment frame, otherwise ⁴	3	3	3
Reinforced concrete moment frames classified in accordance with 780 CMR 3408.10.2.2			
Class A	5	3	4.5
Class B	2.5	2.5	2.5
Dual Systems (See ASCE 7, Section 9.5.2.2.1)			
Steel concentrically braced frame (CBF) with steel moment frames (MF)			
CBF and Special MF, per 6th Ed. SBC ²	5	2.5	4.5
CBF and MF, per 1st-5th Ed. SBC ² , except V, Inverted V, or K Bracing	3.5	2.5	3.5
CBF and MF, per 1st-5th Ed. SBC ² , with V or Inverted V Bracing	3	2.5	3
Otherwise	1.5	1.5	1.5
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordance with 780 CMR 1113.5.1.4a, 5th Ed., with reinforced concrete moment frames in accordance with 780 CMR 3408.10.2.2, Class A.	6	2.5	5
Ordinary reinforced concrete shear wall, as defined in 7th Ed. SBC, with reinforced concrete moment frames in accordance with 780 CMR 3408.10.2.2, Class A	5.5	2.5	4.5

Notes:

1. Systems of previous editions of the State Building Code that meet the ductility requirements of the 7th Edition of the Code are not included in this table.
2. SBC = State Building Code.
3. A diagonal brace is one that frames from a beam to column connection diagonally to another beam to column connection or to a column at its base plate.
4. The seismic resistance of the frame shall be based on its seismic connections being subject to two times the computed forces and moments resulting from seismic load.

3408.10.2.1 Classification of Reinforced Masonry. Existing reinforced masonry shear walls shall be classified for Table 3408-1, as follows:

Class A Minimum total cross-sectional area of reinforcement in the vertical and horizontal direction is 0.002 times the gross cross-sectional area of wall, with a minimum in each direction of 0.0007 times the gross cross-sectional area of wall. Maximum spacing of reinforcing steel bars in grouted cells or bond courses is 6'-0" in one direction and 4'-0" in the other direction, but not less than $\frac{1}{8}$ of the length or height of the wall, whichever is smaller, in each direction. Otherwise meets requirements for reinforced masonry of the basic code.

Class B Same as Class A, except spacing limits for the reinforcing steel bars are exceeded.

Class C Less than the minimum cross-sectional area of reinforcement required for

Class A.

3408.10.2.2 Classification of Reinforced Concrete Moment Frames. Existing reinforced concrete moment frames shall be classified for Table 3408-1, as follows:

Class A Design in accordance with 780 CMR 1113.5.1, 1113.5.1.1, 1113.5.1.2 and 1113.5.1.3, 5th Edition; and ACI 318-83, Sections 11.12.1.1 and 11.12.1.2 for reinforcing of the beam-column joints.

Class B Does not meet all the requirements for Class A.

3408.10.3 Alternate Methods of Analysis and Design. In lieu of the requirements of 780 CMR 1615.0 and 780 CMR 3408.10.2, analysis and design for existing buildings may be in accordance with SEI/ASCE 31 for the loading specified in 780 CMR 1614.0, except that sheathing over light-framed wood walls that is not permitted in 780 CMR 3408.9.3 shall not be used to resist in-plane shear for shear walls, and wood foundations other than piles and poles shall not be used to resist any load. The SER shall document

the use of SEI/ASCE 31 in a report to the building official, and include in said report the assumptions, the methods of analysis, and a description of the analytical results

780 CMR 3409.0 HISTORIC BUILDINGS

3409.1 Scope. The provisions of 780 CMR 3409.0 shall govern all buildings and structures in the Commonwealth which are legally designated as *historic buildings*. 780 CMR 3409.0 shall preempt all other regulations of 780 CMR governing the reconstruction alterations change of use and occupancy, repairs maintenance and additions for the conformity of historic buildings and structures to 780 CMR, with the exception of 780 CMR 122.0 for appeals, or unless otherwise specified (see 780 CMR 120.Y). There is no obligation for owners of historic properties to apply for 780 CMR 3409.0.

3409.1.1 Key Definitions. The following five definitions are found in 780 CMR 3401.1, but are also presented here as such definitions form a significant portion of 780 CMR 3409.0.

Historic Buildings. (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure evaluated by MHC to be a contributing building within a National Register or State Register District. (c) any building or structure which has been certified by the Massachusetts Historical Commission to meet eligibility requirements for individual listing on the National Register of Historic Places. *Historic building* shall be further defined as a *house museum* or *preserved buildings*. All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (see Appendix 780 CMR 120.Y).

Preserved Buildings. (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure certified as a *historic building* by the Massachusetts Historical Commission and not designated a *house museum* in Appendix 780 CMR 120.Y).

Restoration. Restoration is the process of accurately reconstructing or repairing the forms and details of a building or structure or portion thereof as it appeared at a particular period or periods of time by means of removal of later work or the replacement of missing original work

House Museum. A *house museum* is an *historic building* or structure. The principal use of such a building or structure must be as an exhibit of the building or the structure itself which is open to the public not less than 12 days per year, although additional uses, original and/or ancillary to the principal use shall be permitted within the same

building up to maximum of 40% of the gross floor area. *House museums* shall be those listed in Appendix 780 CMR 120.Y. All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (See Appendix 780 CMR 120.Y).

3409.2 House Museum.

3409.2.1 State Building Code Exceptions. A *house museum* shall be subject to the following exceptions:

1. Repairs, maintenance and restoration shall be allowed without conformity to 780 CMR generally, if the provisions of 780 CMR 3409.2.2 have been met.
2. In case of fire or other casualty to a *house museum*, said building may be rebuilt, in total or in part, using such techniques and materials as are necessary to restore it to its original condition and use group.
3. If a *historic building* or structure, as a result of proposed work, would become eligible for certification as a *house museum* and the Massachusetts Historical Commission so certifies by affidavit, such affidavit is submitted to the building official with the permit application, and the building official shall then allow the work to proceed under the provisions of 780 CMR 3409.2.

3409.2.2 Mandatory Safety Requirements. All *house museums* shall comply to the following requirements.

3409.2.2.1 Fire Protection Equipment. Fire protection equipment shall be provided according to the following requirements:

1. **Manual Fire Extinguishing Equipment.** All use groups, other than Residential R-3 and R-4, shall have approved manual fire extinguishing equipment, as determined by the head of the local fire department.
2. **Fire Protective Signaling Systems (Fire Alarm Systems).** All residential buildings in use groups R-1, R-2 and R-3 shall conform to the applicable requirements of 780 CMR 918.0 and 919.0 as applicable. All other use groups shall comply with 780 CMR 3409.2.2.1 items 2.(a) and (b).

(a) **Locations.** Provide smoke detectors in accordance with manufacturers listing and spacing requirements, but not less than one, for every 1200 square feet of floor area per level. In addition, all lobbies, common corridors, hallways and exitway access and discharge routes shall be provided with approved smoke detectors installed in accordance with the

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manufacturers listing and spacing requirements but not more than 30 feet spacing between detectors. All required smoke detectors shall have an alarm audible throughout the structure or building.

(b) Single station and multiple station smoke detection devices. Smoke detectors of single station and multiple station types shall meet the requirements of UL 217 and be listed or approved by a nationally-recognized fire-testing laboratory. All other smoke detectors shall be listed in accordance with UL 268.

3. Manual Pull Stations. A manual fire alarm pull station shall be provided in the natural path of egress in all use groups except R-3 and R-4. Manual pull stations shall be connected to the building fire warning system in conformance with NFPA 72.

3409.2.2.1.1 Supervision. Fire protective signaling systems required by 780 CMR 3409.2.2.1 shall be supervised in accordance with the requirements of 780 CMR 9.00.

Exception. Residential single and multiple station smoke detectors.

3409.2.2.2 Exit Signs and Emergency Lights. Approved exit signs and emergency lighting, where designated by the local building official, shall be provided in compliance with 780 CMR 10.00.

Exception. All *house museums* need not comply with 780 CMR 10.00 if not occupied after daylight hours, except that paths of egress shall have exit signs.

3409.2.2.3 Maximum Occupancy. Occupancy shall be limited by the actual structural floor load capacity as certified by a qualified Massachusetts *registered professional engineer* or *architect* or in accordance with 780 CMR 10.00, whichever is less. Said floor load shall be posted in accordance with the procedures set forth in 780 CMR 120.0, 780 CMR 10.00 and 780 CMR 1617.2. The owner shall submit evidence of this certification and related computations to the building official upon request.

3409.2.2.4 Limited Egress. Where one or more floors of a *house museum* are limited to one *means of egress*, the occupancy load shall be computed as follows:

1. **Floors below the First Story.** Not more than one occupant per 100 square feet of gross floor area with a maximum occupancy of 49.
2. **First Story.** Not more than one occupant per 50 square feet of gross floor

area.

3. Second Story And Above. Not more than one occupant per 100 square feet of gross floor area, or 30 occupants per unit of egress width, whichever condition results in the lesser occupancy load.

3409.2.2.5 Inspections. The *building official* and the fire official shall inspect all *house museums* not less frequently than once every year in order to determine that the building or structure continues to conform to 780 CMR 3409.2. A qualified Massachusetts *registered professional engineer* or *architect* shall certify every five years thereafter as to the exact floor load capacity of the building or structure. The building official shall certify all *house museums* not less frequently than once every year. Fees shall be established at \$25.00 per building per inspection.

3409.2.2.6 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.

3409.2.2.7 Energy Conservation. House museums are exempt from the requirements of 780 CMR 3407.0 and the energy conservation requirements of 780 CMR. Muntins, glazing, sills, molding, shutters) shall be permitted without requiring energy code compliance.

3409.2.2.8 Structural Requirements. House museums need not comply with the wind load and seismic load requirements of 780 CMR 3408.0.

3409.3 Partially Preserved Buildings.

3409.3.1 State Building Code Provisions. A *preserved building* shall be subject to the following provisions.

1. **Existing Systems** - individual components of an existing *building system* may be repaired or replaced in kind without requiring that system to comply fully with the code for new construction. (See 780 CMR 34.00, 780 CMR 3404.3. *New Systems*.)
2. **Replacement in Kind** - when the repair of historic materials including patching, splicing, piecing-in, consolidating or reinforcing is not possible, compatible materials may be substituted which closely convey the form and design as well as the visual appearance of the existing feature.

3409.3.2 State Building Code Exceptions. A *preserved building* shall be subject to the following exceptions. Repairs or in kind replacement of the following features will be allowed on partially preserved buildings so as not to compromise the architectural integrity of the historical characteristics and qualities which contributed to the eligibility for listing in the National Register of Historic Places.

EXISTING STRUCTURES

1. **Roofing** - repair or in kind replacement of an existing historic roof system (i.e., slate, wood, clay, tile, metal) shall be permitted without requiring structural compliance for equivalent new construction providing that dead and live loading requirements have not changed.

2. **Windows** - repair or in kind replacement of existing historic windows (i.e., frames, sash, muntions, glazing, sills, molding, shutters) shall be permitted without requiring energy code compliance.

3. **Entries/Porches** - repair or in kind replacement of existing individual decorative features of an existing system (i.e. columns, balustrades, stairs, pilasters, doors, sidelights) shall be permitted.

4. **Wood Siding/Decorative Elements** - Repair or in kind replacement of an existing system including such items as clapboards, shingles, cornices, brackets, and window and door surrounds shall be permitted.

5. **Masonry** - repair or in kind replacement of masonry units as part of an existing system (i.e., brick, stone, terra cotta, concrete and stucco) shall be permitted.

6. **Metals** - repair or in kind replacement of existing architectural metals (i.e. cast and wrought iron, steel, tin, copper and copper alloys, aluminum, zinc) shall be permitted.

7. **Interior Features** - repair or in kind replacement of non-structural interior features that are important in defining the overall historic character of a building (i.e., columns, cornices, baseboards, fireplace mantels, paneling, window trim, doors, moldings, railings, flooring, plasterwork) shall be permitted.

3409.3.3 Applicability. 780 CMR 3409.3 and 780 CMR 34.00 shall apply to all *preserved buildings*.

3409.3.4 Continuation of Use and Occupancy. The legal use and occupancy of any *preserved building* may be continued without change or further compliance to 780 CMR.

3409.3.5 Inspection Certification and Fees. *preserved buildings* shall not require annual inspection unless otherwise stipulated in 780 CMR 106.5 and Table 106.

3409.3.6 Fire Damage. If a building or structure is damaged from fire or other casualty it may be restored to its original construction or it shall meet the requirements of 780 CMR provided these requirements do not compromise the features for which the building was considered Historic when listed in the National Register of Historic Places.

3409.3.7 Change in Occupancy. See 780 CMR 34.00.

3409.3.8 New Systems. See 780 CMR 34.

3409.3.9 Lesser and Equal Hazard. See 780 CMR 34.00. A *preserved building* classified under unprotected construction Type 2C or 5B shall have waived the requirement to add one to the Hazard Index number (See 780 CMR 34.00, Table 3403).

3409.3.10 Greater Hazard. See 780 CMR 34.00. A *preserved building* classified under unprotected construction Type 2C or 5B shall have waived the requirement to add one to the Hazard Index number (See 780 CMR 34.00, Table 3403).

3409.3.11 Energy Conservation. Preserved buildings are exempt from the energy requirements of 780 CMR 13.00 and 61.00.

Exception. Additions to partially preserved buildings shall comply with the energy provisions of 780 CMR 13.00 or of 780 CMR 61.00, as applicable.

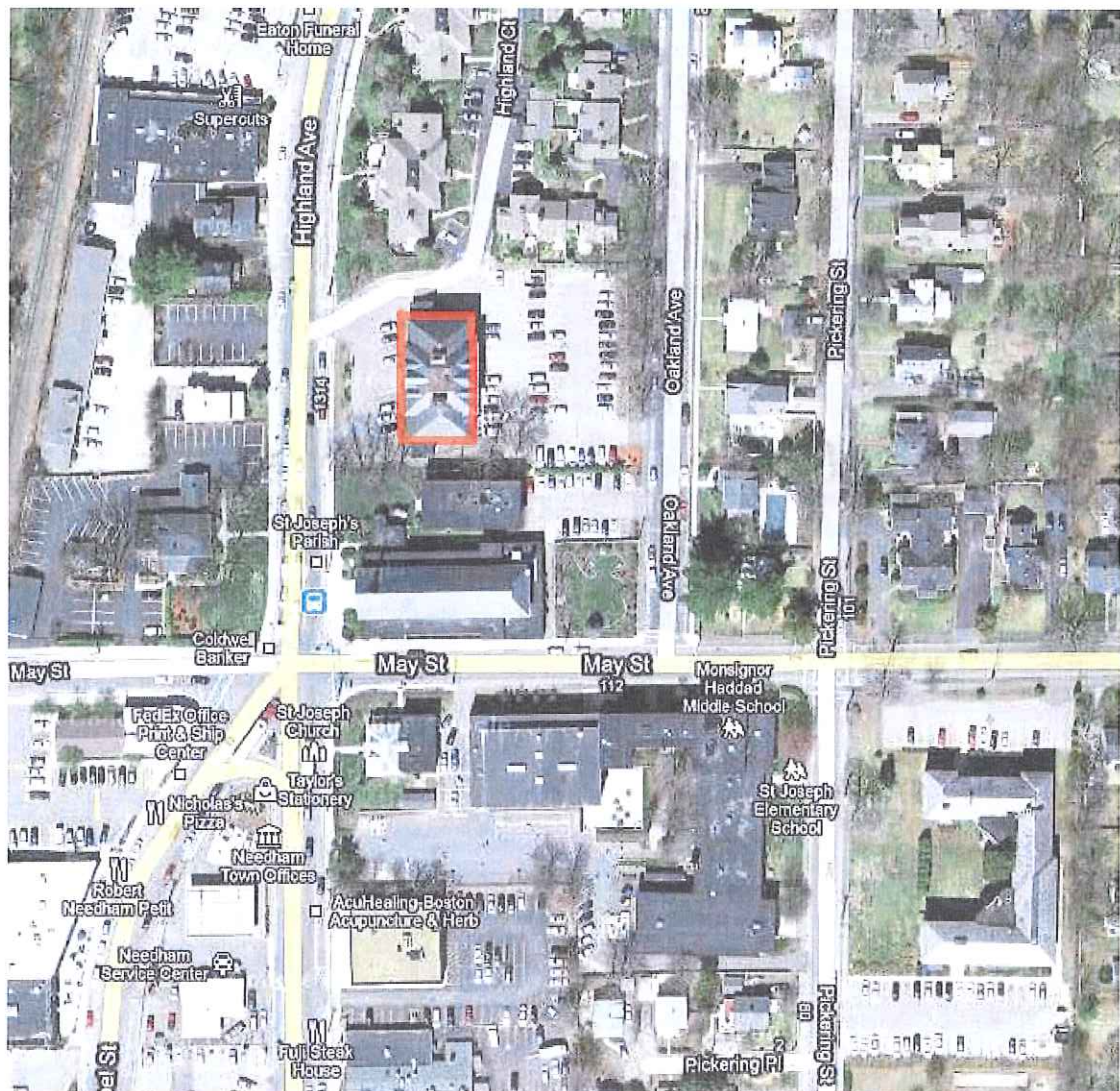
3409.3.13 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.

Traffic and Parking Analysis

The Emery Grover site is located at 1330 Highland Avenue in the Town center. The site is located on the east side of Highland Avenue just north of May Street. There is vehicular access to both Highland Avenue and Oakland Avenue. Two one-way drives serve the site on Highland Avenue and a single two-way drive provides access to Oakland Avenue. There is also an internal roadway connection to a residential property located north of the project site. There are presently 72 parking spaces on the site. There are sidewalks along both Highland Avenue and Oakland Avenue adjacent to the site.

METHODOLOGY

Tetra Tech Rizzo reviewed available site plans and aerial photographs for the project site and conducted a site visit during afternoon commuter peak hours in July 2010. Information obtained during a previous senior center site feasibility site in April 2010 regarding the operations and visitor travel patterns of the existing Senior Center and the adjacent St. Joseph's School were also considered.



Aerial View of site

SITE LOCUS

Highland Avenue is the major north-south thoroughfare through Needham. It carries relatively heavy traffic volumes and experiences some congestion during peak hours. Another period of congestion occurs during student arrivals and dismissals at the St. Joseph's School located on the south side of May Street at Highland Avenue. School buses use May Street to access a pick-up point on Pickering Street southbound adjacent to the school. Parents driving students to and from school primarily enter the school property from Highland Avenue. Parents will also park on Oakland Avenue. Those approaching from the north pass by the Emery Grover site and through the signalized May Street and Highland Avenue intersection. School pick-up/drop-off activity occurs from approximately 7:35 to 8:20 AM and from 2:30 to 3:15 PM. During these hours crossing guards and/or police details are used to control traffic at the May Street/Pickering Street intersection and at the school entrance at Highland Avenue. The traffic signal at May Street and Highland Avenue experiences some back-ups at these time due the increased vehicular and pedestrian traffic.

ISSUES AND OPPORTUNITIES

School dismissal related traffic congestion at the May Street/Highland Avenue intersection impedes access to the Emery Grover site from Highland Avenue. Senior center activities should be scheduled to avoid traffic conflicts with Saint Joseph's school dismissal. Scheduling is not an issue for the senior center during the morning student drop-off period as the senior center is not typically open during these hours.

When in the course of evaluating the previous three sites, there have been discussions from time to time regarding reorganizing traffic flow patterns (adding one-way streets) in the vicinity of the St. Joseph's School. As noted above, attention to scheduling may address any traffic conflicts for the senior center site. However, maintaining the existing two-way street system would best serve the Emery Grover site as it allows traffic coming from the south and east to access the site from low volume streets and avoid the more heavily traveled Highland Avenue.

Left-turns into the site from Highland Avenue and from the site to Highland Avenue can experience long delays during peak hours. Accordingly, during peak hours it may be appropriate to restrict turns from the site to right turns only. Traffic headed south of the site can use the Oakland Avenue exit to the reach Highland Avenue by way of May Street where there is a signal. The left-turn should be monitored but not restricted initially. There are two southbound lanes on Highland Avenue where the left-turns occurs so traffic heading south can easily bypass traffic waiting to turn left into the site.

The project site has twenty parking spaces located essentially adjacent to the building. Eight of these are at the front (Highland Avenue side) of the building and 12 are to the back side. The remaining 52 on-site spaces are located to the east of these 12 spaces. Parkers using these spaces do not have clear pathways. They must walk through these 12 spaces. Also, the parking bays are oriented in a north-south pattern such that parkers will likely walk between parked cars (rather than along the drive aisles) to reach the building. The parking bay adjacent to Oakland Avenue is a dead end aisle. Parkers entering this bay if and when it is full must back out of the bay to continue searching for a space.

Traffic increase on Oakland associated with the senior center use will be modest but likely not occur during commuter peak hours. The Oakland Street access to parking lot should be kept in use to allow seniors an alternative route to the site that does not involve making left-turns on to or off of the much more congested Highland Avenue.



PARKING

Provision of adequate parking is a concern for the subject site. Based on our prior research regarding parking requirements for senior centers and review of this information by the Town a goal has been established to provide a minimum of 100 spaces at the senior center site.

The Emery Grover site includes 72 spaces but the layout of these spaces is not optimal for pedestrian or traffic circulation. Potential changes to the existing parking to address these "deficiencies" would reduce the parking supply by eight to ten spaces. Modifications to the site plan were considered to increase the on-site parking supply. However, since there is very limited green space on the site today, the opportunities to increase the parking supply are limited as well. The landscaped island along Highland Avenue could be removed and with some regarding used for another row of angle parking adding up to four parking spaces. Another four or five spaces could be striped on the northern side of the building.

Off-site parking is available along Highland Avenue and Oakland Avenue. There are as many as ten on-street spaces located within 100 feet of the project site perimeter. The availability of these spaces during the day is unknown. There would certainly be competition for these spaces during the school year during dismissal time.

Keeping existing remote parking spaces will not provided significant benefit to the seniors. Walking distances will be perceived as excessive by seniors and they will not use these spaces. However, the parking spaces may be retained for employees/staff especially if an exchange can be made for the 17 reserved parking space currently at the lot between the Stephen Palmer House and Greene's Field to the lot on the opposite side of the Stephen Palmer House along May Street. Similarly, the 20 on-street parking spaces along Pickering can be assigned to the Church which currently has an agreement to use 20 at the Emery Grover lot. In summary:

72 space existing on site
10 on-street adjacent to site
17 possible for staff at Stephen Palmer House
99 Total

One benefit of the Emery Grover site is its downtown location. It is a 5 minutes' walk to Town Hall. There is a bus stop in front of the church on Highland Ave. Access to public transit can help reduce the demand for parking at the

site by a few percentage points. The site may also accommodate some walk in and drop-off traffic due to its convenient location.

CONCLUSION

Overall, the Emery Grover site is a viable location from a traffic perspective subject to securing an adequate supply of parking. It offers the advantage of proximity to the existing senior center, meaning that seniors are currently accustomed to traveling to this site and familiar with the roadway and traffic conditions surrounding the site. Also, its proximity to other city services and retail establishments accommodates multi-purpose trip making by seniors.

Preliminary Project Costs

TOTAL PROJECT COST ESTIMATE

HARD COST			
HazMat			50,000
	Environmental Site Review		10,000
	HazMat Abatement Contingency		40,000
General Contractor			6,081,000
	DG Jones Estimate August 3, 2010		5,847,000
	Cost Estimate Construction Contingency	10%	included above
	Escalation to Spring 2012	4%	234,000
Furniture, Fixtures & Equipment			300,000
	Furniture		200,000
	Equipment (phones, computers, etc.)		100,000
Hard Cost Subtotal			\$6,431,000
SOFT COST			
Permits & Approvals			20,000
	Conservation Commission		-
	Planning Board Site Plan Approval		5,000
	Historical Reviews and Approvals Consultant		15,000
	Town Meeting Zoning Change		-
Architecture & Engineering			720,410
	A&E (inc. traffic, acoustical, historic, LEED, etc.)	10%	623,100
	A&E Reimbursables	10%	62,310
	FF&E Specification & Purchasing	10%	20,000
	Geotechnical Engineer		10,000
	Survey & Layout		5,000
Testing & Inspections			10,000
	Wood, Concrete & Steel Inspection	0.25%	10,000

Project Management			216,792
	Owner's Project Manager	3%	216,792
Moving			25,000
Advertising & Bidding			10,000
	Public Bidding (Advertising & Printing)		10,000
Legal			10,000
	Contracts		10,000
	Bid Protests		NIC
Other			-
Soft Cost Subtotal			\$1,013,000
CONTINGENCY			
Contingency			1,117,200
	Owner's Contingency	15%	1,117,200
Project Total			<u>\$8,561,200</u>

PRELIMINARY CONCEPTUAL BREAKDOWN OF POTENTIAL CPA FUNDING FOR EMERY GROVER

Potential CPC Funded Items	DGJ estimate	added scope	amount	
Substructure	\$76,149	\$20,000	\$96,149	
Superstructure	\$214,970	\$120,000	\$334,970	
Roof	\$270,328	\$105,000	\$375,328	
Exterior Wall	\$75,446	\$40,000	\$115,446	
Exterior Windows and Doors	\$198,844	\$170,000	\$368,844	includes accessible entry vestibule
Elevator	\$125,000		\$125,000	
Ramp		\$120,000	\$120,000	
Subtotal			\$1,535,737	
General Conditions @ 8%	8%		\$122,859	
Estimating Contingency @ 15%	15%		\$248,789	
Total Construction Cost			\$1,907,385	
Total Soft Cost			\$629,437	
Total Cost CPA funded Items			\$2,536,823	
<u>Total Project Cost Estimate</u>			\$8,561,200	
Resultant Project Cost after CPA funding			\$6,024,377	say \$6.1 M rounded

SUMMARY

Gross Floor Area (in square feet) = **22,270**

Element Name	Cost \$	\$/sf	% of Bldg.
Demolition/Alteration	341,311	15.33	7.78%
Substructure	105,169	4.72	2.40%
Superstructure	314,970	14.14	7.18%
Stairs	184,000	8.26	4.20%
Roof Finish	379,114	17.02	8.64%
Exterior Walls	103,760	4.66	2.37%
Exterior Windows & Doors	286,665	12.87	6.54%
Interior Walls	138,602	6.22	3.16%
Interior Windows & Doors	97,950	4.40	2.23%
Finishes	375,745	16.87	8.57%
Specialties	50,300	2.26	1.15%
Equipment	102,450	4.60	2.34%
Furnishings	123,527	5.55	2.82%
Special Construction	0	0.00	0.00%
Conveying	162,117	7.28	3.70%
Plumbing	216,981	9.74	4.95%
Fire Protection	135,512	6.08	3.09%
HVAC	818,525	36.75	18.66%
Electrical	448,844	20.15	10.23%
Sub-Total Building	4,385,542	196.93	100%
Building Site Work/Site Utilities	279,000	12.53	
Sub-Total Construction	4,664,542	209.45	
General Requirements	9.00%	419,809	18.85
Escalation taken to mid-point of construction		excluded	excluded
Building Permit Fees		excluded	excluded
Estimating Contingency	15.00%	762,653	34.25
Construction Contingency		excluded	excluded
LEED certification		excluded	excluded
Total Construction Cost	5,847,004	262.55	

Description	Qty	Unit	Rate	Amount
<u>Demolition/Alteration</u>				
Gut interior including stairs, partitions, doors, finishes, MEP, etc	22,270	sf	6.50	144,755
Form opening & mg to:-				
- exterior walls	1	ls	6,500.00	6,500
- interior walls	1	ls	6,000.00	6,000
- interior floors	1	ls	11,000.00	11,000
Infill extg openings	1	ls	5,000.00	5,000
Demolish brick bearing walls & temporary support	480	lf	45.00	21,600
Remove brick @ filled in window, 2nd floor, south	5	ea	5,000.00	25,000
Hazardous material abatement, allow:-				
- remove 1050 gallon underground oil tank	1	ls	3,200.00	3,200
- mercury ballasts	1	ls	4,500.00	4,500
- interior lead paint	1	ls	5,500.00	5,500
- window caulking	1	ls	350.00	350
- asbestos abatement	1	ls	55,000.00	55,000
Allow for:-				
- sawcut extg slab	476	lf	10.00	4,760
- demolish extg concrete slab	1,136	sf	4.50	5,112
- trenching & backfill w/excavated material	126	cy	45.00	5,670
- new concrete slab w/sub base, vapor barrier & insulation complete	1,136	sf	15.10	17,154
- connection between new & extg slab	696	lf	10.00	6,960
- make safe MEP equipment before work commences	1	ls	750.00	750
- temporary screens for noise & dust control				Not Required
- remove rubbish off site	1	ls	12,500.00	12,500
<u>Demolition/Alteration</u>	Total			341,311
<u>Substructure</u>				
Allow for new concrete column footings, allow	16	ea	1,514.81	24,237
Allow for new strip foundations & walls	170	lf	476.07	80,932
<u>Substructure</u>	Total			105,169
<u>Superstructure</u>				
Main Level				
Light gage metal joist & beam hangers at mortise and tenon connections	1	ls	4,500.00	4,500
Steel framing, allow @ 5 lb/sf	29,450	lb	2.50	73,625
PT ledger bolted to extg wall	200	lf	12.00	2,400
Fasten extg joists to ledger	202	ea	5.00	1,010
Temporary shoring of joists	200	lf	6.00	1,200
Repair of rotting joists as required, allow	1	ls	2,500.00	2,500
Post & beam framing associated with bearing wall removal, allow	1	ls	5,000.00	5,000
Upper Level				
Light gage metal joist & beam hangers at mortise and tenon connections	1	ls	4,500.00	4,500
Steel framing, allow @ 5 lb/sf	29,450	lb	2.50	73,625
PT ledger bolted to extg wall	200	lf	12.00	2,400
Fasten extg joists to ledger	202	ea	5.00	1,010
Temporary shoring of joists	200	lf	6.00	1,200
Repair of rotting joists as required, allow	1	ls	2,500.00	2,500
Post & beam framing associated with bearing wall removal, allow	1	ls	5,000.00	5,000
Attic Level				

Description	Qty	Unit	Rate	Amount
Light gage metal joist & beam hangers at mortise and tenon connections	1	ls	4,500.00	4,500
Truss reinforcing, allow	1	ls	7,500.00	7,500
Sister all joists	1	ls	10,000.00	10,000
Roof Framing				
Additional reinforcing as required, allow	1	ls	12,500.00	12,500
General				
Allow for additional reinforcing of existing floors	1	ls	100,000.00	100,000
Superstructure	Total			314,970
Stairs				
Stair complete w/railings, etc	6	fir	14,000.00	84,000
EO for stair to be "ornamental for public use	1	ea	100,000.00	100,000
Stairs	Total			184,000
Roof Finish				
Remove slate roofing & replace w/new to match extg (including dormers)	6,894	sf	15.00	103,410
Felt to ditto	6,894	sf	0.25	1,724
Replace deteriorated sheathing, allow 10%	689	sf	2.00	1,378
Replace copper flashings	698	lf	10.00	6,980
Replace copper valleys/hips	517	lf	65.00	33,605
Replace snow guards	1	ls	5,000.00	5,000
Repair wood (or metal) at dormer faces & repaint	6	ea	650.00	3,900
Remove plexiglass from dormer window	10	ea	35.00	350
Remove window sash & restore	10	ea	402.00	4,020
Reconstruct clock face & working clock parts	1	ls	10,000.00	10,000
Remove copper gutter & replace in kind	433	lf	23.00	9,959
Replace metal soffit to match extg	1	ls	80,000.00	80,000
Repaint soffit	433	lf	4.00	1,732
Remove skylight & infill	175	sf	46.60	8,155
Replace metal flat seam roofing	698	sf	19.00	13,262
Disassemble brick chimneys, salvage brick & rebuild, 6' 3" x 11' 3" x 12' 6" hi	2	ea	34,312.50	68,625
Raised metal cap to chimney, 6' 3" x 11' 3"	2	ea	2,460.94	4,922
Replace membrane roofing at porticos	818	sf	4.50	3,681
Replace copper flashings	158	lf	10.00	1,580
Replace copper valleys/hips	78	lf	65.00	5,070
Remove copper gutter & replace in kind	108	lf	23.00	2,484
Replace patch areas of metal soffit to match extg, allow 15%	16	lf	85.00	1,360
Repaint soffit	108	lf	4.00	432
Replace leader w/copper leader	394	lf	19.00	7,486
Roof Finish	Total			379,114
Exterior Walls				
Cut out & repoint mortar joints	3,146	sf	18.00	56,628
Remove & reset loose or shifted bricks, allow	1	ls	2,500.00	2,500
Caulk inside corners of brick at recesses under arched windows	150	lf	8.00	1,200
Reset/replace/stitch brick at cracked or damaged brick	1	ls	3,000.00	3,000

Description	Qty	Unit	Rate	Amount
Remove brick at bowing areas, reset & pin bricks in place	1	ls	5,000.00	5,000
North portico, reinforce arches	240	lf	25.00	6,000
Remove concrete at Upper level sills & apply masonry coating	128	lf	9.00	1,152
Repairs to interior face of exth wall	14,140	sf	2.00	28,280
Exterior Walls	Total			103,760
Exterior Windows & Doors				
Remove unit air conditioner	1	ls	500.00	500
Remove storm window	10	ea	35.00	350
Remove screen	8	ea	35.00	280
Remove non-original double hung window	4	ea	45.00	180
Remove plexiglass from window	6	ea	35.00	210
Replace extg window	2,117	sf	85.00	179,945
New window @ 2nd floor, south wall	5	ea	5,000.00	25,000
Work to exterior doors, allow	2	ea	750.00	1,500
Accessibility to North Portico:-				
- glass enclosure	536	sf	90.00	48,240
- EO for dl doors to ditto	2	ea	750.00	1,500
- remove concrete finish and lay recessed walk off mat	347	sf	30.00	10,410
Remove raised granite threshold, cut door, modify & new hardware, dl	2	ea	650.00	1,300
Close extg main entry door	1	ls	17,250.00	17,250
Exterior Windows & Doors	Total			286,665
Interior Walls				
Interior drywall partitions	16,341	sf	6.50	106,217
EO for ditto being:-				
- plumbing wall	725	sf	2.55	1,849
- fire rated, allow 25%	4,085	sf	0.65	2,655
- bearing wall	2,451	sf	5.00	12,255
- batt insulation, allow 25%	4,085	sf	0.95	3,881
- impact resistant gwb, allow 25%	4,085	sf	0.15	613
- moisture resistant gwb	2,000	sf	0.35	700
Allow for:-				
- sealant	5,028	lf	0.95	4,777
- blocking	2,514	lf	2.25	5,657
Interior Walls	Total			138,602
Interior Windows & Doors				
Flush wood door complete w/hollow metal frame, hardware, accessories & paint:-				
- sl	48	ea	1,215.00	58,320
- dl	4	ea	1,810.29	7,241
EO ditto for:-				
- fire rating, per leaf, allow 25%	14	ea	100.00	1,400
- glazed opening, 1' x 2', per leaf, allow 25%	14	ea	135.00	1,890

Description	Qty	Unit	Rate	Amount
- half glazed	3	ea	130.00	390
Borrowed glazed lights, allow	484	sf	50.00	24,200
Allow for access doors	1	ls	500.00	500
Allow for:-				
- sealant	1,932	lf	0.95	1,835
- blocking	966	lf	2.25	2,174
Interior Windows & Doors	Total			97,950
Finishes				
Floors	22,270	sf	7.00	155,890
Base	22,270	sf	2.00	44,540
Walls	22,270	sf	2.00	44,540
Ceilings	22,270	sf	4.50	100,215
Soffits, bulkheads complete w/paint	2,590	sf	9.00	23,310
Allow for:-				
- blocking	1	ls	3,500.00	3,500
- sealant	1	ls	2,250.00	2,250
- access panels	1	ls	1,500.00	1,500
Finishes	Total			375,745
Specialties				
Visual display boards, allow	3	ea	750.00	2,250
Toilet compartment	16	ea	1,150.00	18,400
Toilet compartment, handicap	6	ea	1,225.00	7,350
Urinal screen	6	ea	275.00	1,650
Directory	1	ea	900.00	900
Interior signage, allow per door	52	ea	75.00	3,900
Fire extinguisher mounted in recessed cabinet	6	ea	250.00	1,500
Bathroom accessories to:-				
- multiple toilet	6	ea	2,350.00	14,100
- janitor's closet	1	ea	250.00	250
Specialties	Total			50,300
Equipment				
Kitchen appliances:-				
- refrigerator	1	ea	775.00	775
- microwave oven	1	ea	325.00	325
Projection screen	2	ea	675.00	1,350
Catering kitchen	1	ls	75,000.00	75,000
Pantry equipment	1	ls	25,000.00	25,000
Equipment	Total			102,450
Furnishings				

Description	Qty	Unit	Rate	Amount
Floor mat & frame, 6' x 4'	1	ea	752.00	752
Window treatment, allow	1	ls	40,000.00	40,000
Casework:-				
- Plam base cabinet w/counter top	45	lf	325.00	14,625
- Wall cabinet	15	lf	160.00	2,400
- Corian countertops in Toilets	51	lf	250.00	12,750
- Storage room shelving, allow	1	ea	1,500.00	1,500
- additional casework	1	ls	50,000.00	50,000
Display case @ Entry	1	ea	1,500.00	1,500
<u>Furnishings</u>	<u>Total</u>			123,527
<u>Special Construction</u>				
No Work in this Element				
<u>Special Construction</u>	<u>Total</u>			0
<u>Conveying</u>				
Elevator, machine room less type, hospital size, 3500 lb, 4# stops, front & rear opening	1	ea	124,900.00	124,900
Dumb waiter	1	ea	25,000.00	25,000
<u>Sub Bid</u>	<u>Total</u>			149,900
Builders work in connection with Conveying @ 3%	1	ls	4,497.00	4,497
General Contractor's overhead and profit @ 5%	1	ls	7,719.85	7,720
<u>Conveying</u>	<u>Total</u>			162,117
<u>Plumbing</u>				
Sanitary fixtures electronic on/off, low water w/accessories, pipework etc	48	ea	3,330.00	159,840
- water heater	1	ea	17,500.00	17,500
- floor drain	4	ea	575.00	2,300
- exterior wall hydrant, freezeproof	4	ea	885.00	3,540
- interior wall hydrants & clean outs, allow	1	ls	750.00	750
Underground pipework	75	lf	46.00	3,450
New natural gas piping distribution system for HVAC units/water heater	1	ls	10,000.00	10,000
Seismic restraint, allow	1	ls	500.00	500
Test & balance	1	ls	2,750.00	2,750
<u>Sub Bid</u>	<u>Total</u>			200,630
Builders work in connection with Plumbing @ 3%	1	ls	6,018.90	6,019
General Contractor's overhead and profit @ 5%	1	ls	10,332.45	10,332
<u>Plumbing</u>	<u>Total</u>			216,981

Description	Qty	Unit	Rate	Amount
<u>Fire Protection</u>				
Service into building	1	ls	2,750.00	2,750
Backflow preventer on extg water service	1	ea	5,850.00	5,850
Wet sprinkler system to entire building including Attic (gfa)	22,270	sf	5.00	111,350
Seismic restraint, allow	1	ls	2,000.00	2,000
Test & balance	1	ls	3,350.00	3,350
Sub Bid	Total			125,300
Builders work in connection with Fire Protection @ 3%	1	ls	3,759.00	3,759
General Contractor's overhead and profit @ 5%	1	ls	6,452.95	6,453
<u>Fire Protection</u>	Total			135,512
<u>HVAC</u>				
Equipment	22,270	sf	9.00	200,430
Geothermal system, allow	1	ls		excluded
Ductwork	22,270	sf	13.00	289,510
Pipework	22,270	sf	6.75	150,323
Automatic temperature control system	22,270	sf	4.00	89,080
Allow for seismic restraint, vibration isolation, etc	1	ls	7,500.00	7,500
Test & balance	1	ls	20,000.00	20,000
Sub Bid	Total			756,843
Builders work in connection with HVAC @ 3%	1	ls	22,705.28	22,705
General Contractor's overhead and profit @ 5%	1	ls	38,977.39	38,977
<u>HVAC</u>	Total			818,525
<u>Electrical</u>				
Panelboards, Etc.	22,270	sf	0.80	17,816
Feeders	22,270	sf	0.50	11,135
Small Power	22,270	sf	3.00	66,810
Lighting LED low energy use lamps & daylighting/use controls	22,270	sf	9.25	205,998
Fire Alarm System	22,270	sf	2.75	61,243
Tel/Data System (empty conduit system)	22,270	sf	0.50	11,135
Security System (fully cable system)	22,270	sf	0.70	15,589
Grounding	22,270	sf	0.35	7,795
Allow for seismic restraint	1	ls	2,500.00	2,500
Test	1	ls	15,000.00	15,000
Sub Bid	Total			415,020
Builders work in connection with electrical @ 3%	1	ls	12,450.59	12,451
General Contractor's overhead and profit @ 5%	1	ls	21,373.50	21,374
<u>Electrical</u>	Total			448,844

[illegible]

Gross Floor Areas

<u>Level</u>	<u>GFA (sf)</u>	<u>Perimeter (lf)</u>
Lower Level	5,890	
Main Level	5,890	
Upper Level	5,890	
Attic Level	4,600	
Total	22,270	

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